



## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

<b>(51) International Patent Classification <sup>6</sup> :</b> <b>C09K 21/14, E06B 5/16</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 98/30654</b> <b>(43) International Publication Date:</b> 16 July 1998 (16.07.98)
<b>(21) International Application Number:</b> PCT/GB98/00048 <b>(22) International Filing Date:</b> 8 January 1998 (08.01.98) <b>(30) Priority Data:</b> 9700449.3      10 January 1997 (10.01.97)      GB <b>(71) Applicant (for all designated States except US):</b> REDDIPLEX GROUP PLC [GB/GB]; The Furlong, Droitwich, Worcestershire WR9 9GB (GB). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> BOOT, Peter, Lawrence [GB/GB]; Oakenmore, Grafton Flyford, Worcestershire WR9 9BG (GB). <b>(74) Agent:</b> BARKER, BRETTELL & DUNCAN; 138 Hagley Road, Edgbaston, Birmingham B16 9PW (GB).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, GW, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i>
<b>(54) Title:</b> NON-HALOGENATED INTUMESCENT COMPOSITIONS  <b>(57) Abstract</b>  A non-halogenated intumescent composition comprising a carrier ingredient and an intumescent ingredient can be formed into elongate strips (e.g. by extrusion) for use as fire seals. The intumescent strip may optionally be held within a cover-member, the cover-member constituting either a housing for the strip or a skin integral with the strip. A smoke seal, weatherstrip or the like may be attached to a surface of the strip or of the cover-member.		

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NI	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CJ	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

## NON-HALOGENATED INTUMESCENT COMPOSITIONS

This invention relates to non-halogenated intumescent compositions and to articles made therefrom.

5

When an intumescent material is subjected to heat and/or flame, the material swells to form a foam-like charrable material. Under the continued action of the heat and/or flame, the outer layer sets to a rigid char, isolating the material below the char and preventing further combustion.

10

However, many known compositions which include intumescent materials have been found to evolve toxic products of decomposition when subjected to heat and/or flame.

15

Thus, the occupants of a building in which there is a burning article made from an intumescent composition may be more at risk of poisoning from inhaling the products of the combustion than of physical injury caused by burns.

20

Furthermore, many countries have introduced legislation to restrict the level of toxic emissions into the environment, while other countries intend to do so in the foreseeable future.

25

We have found that the use of non-halogenated materials to make intumescent compositions minimises such toxic emissions when the compositions and articles made therefrom are subjected to heat and/or flame.

Accordingly, the present invention provides a non-halogenated intumescent composition, said composition consisting essentially of (a) a carrier ingredient and (b) an intumescent ingredient.

5 Suitably, the carrier ingredient (a) is a non-halogenated thermoformable plastics material, for example ethylene vinyl acetate copolymer. Other suitable materials include polyethylene, polypropylene, polystyrene, polyvinyl acetate, polyacrylonitrile, natural rubber, styrene butadiene rubber, acrylonitrile styrene butadiene rubber, ethylene octylene,  
10 ethylene propylene rubber and ethylene propylene diene monomer rubber. Thermoformable polyester-, polyamide-, epoxy- and phenolic resins may also be used as the carrier ingredient (a).

The intumescent ingredient (b) may be, for example, graphite.  
15 Alternative intumescent ingredients include alumino-silicate-based materials such as vermiculite.

The intumescent composition may, if desired, contain an effective amount of one or more non-halogenated flame-retardant additives (c).  
20 Examples of such additives include hydrous aluminium oxide, red amorphous phosphorus and other phosphorus compounds, such as ammonium mono-phosphate or an ammonium poly-phosphate.

The present invention also provides an article made from a  
25 non-halogenated intumescent composition, said composition consisting essentially of a carrier ingredient and an intumescent ingredient, in which the article comprises an elongate strip, wherein said carrier (a) and said intumescent ingredient (b) have been compounded together prior to forming of the strip.

30

Compounding may be carried out, for example, by means of an internal mixer, an open mill or an extruder-compounder.

The forming of such an elongate strip may be achieved by any  
5 processing method compatible with the intumescent composition.

A particularly preferred method is the extrusion of the intumescent composition through a suitably-configured die to form an elongate strip.

10 Such a strip may be used as a fire seal for doors and/or windows.

To the extent that other processing methods are compatible with the intumescent composition, articles according to the present invention might, for example, be made by calendering, coating or vacuum-moulding.

15 Clearly, the composition must contain a sufficient amount of the intumescent ingredient to provide acceptable protection in a fire situation. The amount of the intumescent ingredient (b) may be, for example, present in the composition in an amount of 5 - 60%, preferably at least 30% and  
20 especially at least 39%, by total weight of the composition.

In a further embodiment of the present invention, a cover-member is provided to at least partly enclose the intumescent strip.

25 Accordingly, the present invention further provides an intumescent article comprising a cover-member which is adapted to at least partly enclose an elongate strip of a non-halogenated intumescent composition.

The cover-member may, for example, constitute a housing having an  
30 integral cavity to contain the elongate strip. The cover-member may itself

constitute a decorative outer surface for the intumescent article or it may have decorative or instructional matter applied thereto.

Alternatively, the cover-member may constitute a skin which at least  
5 partly encloses the intumescent strip.

The cover member may be made of a rigid plastics material or of a flexible plastics material. These plastics materials may also be non-halogenated. The elongate strip preferably has a rectangular cross-section,  
10 and the cover member extends round three sides of the strip.

Intumescent articles according to the present invention may further be provided with a smoke seal, weatherstrip or similar sealing-member (hereinafter "weatherstrip") which is attached to the outer surface thereof,  
15 for example where the article is to be affixed to the frame of a door - or window - aperture.

The weatherstrip may conveniently be attached directly to an outer surface of the intumescent strip, or to an outer surface of the skin, or to an  
20 outer surface of the cover-member.

Attachment of the weatherstrip may be achieved by fusion-welding, by ultrasonic welding, or by means of a suitable adhesive.

25 By way of illustration, an intumescent article according to one embodiment of the present invention comprises an elongate strip of an intumescent material enclosed in a flexible skin and having a weatherstrip (as hereinbefore defined) attached to the outer surface of said skin.

30 Such an article may be made as follows:

A strip of non-halogenated intumescent composition and skin are formed by co-extrusion and the extrudate is then cooled to ambient temperature. For example, the strip is of rectangular cross-section, and the skin is extruded to cover three sides of the strip. An elongate portion of the outer surface of the skin and a correspondingly-shaped portion of the outer surface of a weatherstrip are simultaneously heated to a sufficient temperature to tackify the said surfaces. The surfaces are then brought together to form a continuous permanent joint. The article (comprising the intumescent strip with its attached weatherstrip) is then cut into discrete lengths, which may be coiled for convenient storage.

## CLAIMS

1. A non-halogenated intumescent composition, characterised by (a) a carrier ingredient and (b) an intumescent ingredient.
- 5 2. A composition according to claim 1, characterised in that the carrier (a) is a non-halogenated, thermoformable plastics material.
3. A composition according to claim 1 or 2, characterised in that the  
10 carrier (a) is an ethylene/vinyl acetate copolymer.
4. A composition according to claim 1 or 2, characterised in that the carrier (a) is polyethylene, polypropylene, polystyrene, polyvinyl acetate, polyacrylonitrile, natural rubber, styrene/butadiene rubber,  
15 acrylonitrile/styrene/butadiene rubber, ethylene octylene, ethylene/propylene rubber or ethylene/propylene diene monomer rubber.
5. A composition according to claim 1 or 2, characterised in that the carrier (a) is a thermoformable polyester-, polyamide-, epoxy- or phenolic  
20 resin.
6. A composition according to any one of claims 1 to 5, characterised in that the intumescent ingredient (b) is graphite.
- 25 7. A composition according to any one of claims 1 to 5, characterised in that the intumescent ingredient (b) is an alumino-silicate-based material, for example vermiculite.



8. A composition according to any one of claims 1 to 7, characterised in that it additionally contains an effective amount of one or more non-halogenated flame-retardant additives (c).

5 9. A composition according to claim 8, characterised in that the additive (c) consists essentially of hydrous aluminium oxide or red amorphous phosphorus.

10 10. A composition according to claim 8, characterised in that the additive (c) consists essentially of ammonium mono-phosphate or an ammonium poly-phosphate.

11. A composition according to any one of claims 1 to 10, characterised in that the intumescent ingredient (b) is present in an amount of 5 to 60%  
15 by total weight of the composition.

12. A composition according to claim 11, characterised in the ingredient (b) is present in an amount of at least 30%, for example at least 39%, by total weight of the composition.

20

13. An article made from a composition according to any one of claims 1 to 12, characterised in that it comprises an elongate strip wherein said carrier (a) and said intumescent ingredient (b) have been compounded together prior to forming said strip.

25

14. An article comprising an intumescent strip made of non-halogenated intumescent composition formed by a carrier ingredient and an intumescent ingredient compounded together and formed into an elongate strip.

15. An article according to claim 13 or claim 14, characterised by a cover-member which at least partly encloses said elongate strip.

16. An article according to claim 15, characterised in that the cover member constitutes a skin which at least partly encloses said elongate strip.

17. An article according to claim 15, characterised in that the cover-member constitutes a housing having an integral cavity to contain said elongate strip.

10

18. An article according to any of claims 15 to 17, characterised in that the cover-member is made of a flexible plastics material.

19. An article according to any of claims 15 to 17, characterised in that the cover-member is made of a rigid plastics material.

20. An article according to any of claims 13 to 19, characterised in that a smoke seal, weatherstrip or the like is attached to an outer surface of the elongate strip or to an outer surface of the cover-member.

20

21. An article according to claim 20, characterised by an elongate strip of an intumescent material enclosed in a flexible skin and having a smoke seal, weatherstrip or the like attached to the outer surface of said flexible skin.

25

22. An article according to any of claims 15 to 21, characterised in that the elongate strip has a rectangular cross-section, and the cover-member extends round three sides of the strip.

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 98/00048

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 6 C09K21/14 E06B5/16

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 C09K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 945 015 A (MILNER BRUCE A ET AL) 31 July 1990	1-6, 8, 10-13
Y	see the whole document ---	14-22
Y	EP 0 745 751 A (REDDIPLEX GROUP PLC) 4 December 1996 see the whole document ---	14-22
X	US 4 722 945 A (WOOD KENNETH ET AL) 2 February 1988 see the whole document ---	1, 2, 4, 6-12
X	EP 0 302 987 A (WOLMAN GMBH DR ; DOLLKEN & CO GMBH W (DE)) 15 February 1989 see page X ---	1-6, 8, 10-14
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

### Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

- "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- "3" document member of the same patent family

Date of the actual completion of the international search

7 April 1998

Date of mailing of the international search report

17/04/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Shade, M

# INTERNATIONAL SEARCH REPORT

national Application No

PCT/GB 98/00048

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication where appropriate, of the relevant passages	Relevant to claim No.
P,X	GB 2 309 729 A (DIXON INTERNATIONAL LTD) 6 August 1997 see the whole document ---	1,2,6, 13,14
A	US 4 868 053 A (OHM CHRISTIAN ET AL) 19 September 1989 see the whole document ---	1-3,8,9
A	US 4 632 946 A (MUENCH VOLKER ET AL) 30 December 1986 see the whole document ---	1,4,5, 13,14
A	US 5 262 454 A (LEROUX ROLAND ET AL) 16 November 1993 see claims 1,5 ---	1,2,6,7
A	US 4 529 742 A (VON BONIN WULF ET AL) 16 July 1985 see column 4, line 27 - line 43 ---	1,6,7
A	GB 2 287 740 A (ENVIRONMENTAL SEALS LTD) 27 September 1995 see the whole document ---	13-22
A	GB 2 070 114 A (LORIENT POLYPROD LTD;TYNETOWER LTD) 3 September 1981 see the whole document -----	13-22

# INTERNATIONAL SEARCH REPORT

Information on patent family members

national Application No

PCT/GB 98/00048

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4945015 A	31-07-90	AU 602008 B AU 7913287 A CA 1295782 A EP 0315649 A WO 8802019 A GB 2212505 A,B	27-09-90 07-04-88 11-02-92 17-05-89 24-03-88 26-07-89
EP 0745751 A	04-12-96	GB 2298159 A AU 6465396 A WO 9740971 A	28-08-96 19-11-97 06-11-97
US 4722945 A	02-02-88	EP 0245779 A GB 2190381 A,B	19-11-87 18-11-87
EP 0302987 A	15-02-89	DE 3872788 A	20-08-92
GB 2309729 A	06-08-97	NONE	
US 4868053 A	19-09-89	DE 3713671 A DE 3803269 A CA 1318066 A DE 3875781 A EP 0287928 A ES 2052631 T JP 63280754 A	17-11-88 17-08-89 18-05-93 17-12-92 26-10-88 16-07-94 17-11-88
US 4632946 A	30-12-86	DE 3401835 A EP 0149813 A	25-07-85 31-07-85
US 5262454 A	16-11-93	DE 4013161 A AT 118233 T CA 2041102 A DE 59104525 D EP 0453912 A JP 2666004 B JP 6057140 A	07-11-91 15-02-95 26-10-91 23-03-95 30-10-91 22-10-97 01-03-94
US 4529742 A	16-07-85	DE 3306698 A EP 0120253 A JP 59166521 A	30-08-84 03-10-84 19-09-84

# INTERNATIONAL SEARCH REPORT

Information on patent family members

national Application No

PCT/GB 98/00048

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2287740 A	27-09-95	NONE	
GB 2070114 A	03-09-81	NONE	